

Reported Tuberculosis Morbidity

United States, 1949-1951

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The effective and economical operation of a tuberculosis control program depends upon adequate knowledge of the extent and character of the services needed. One useful source of such information is newly reported tuberculosis cases—those cases which first become known to the health department—and the variations in some of their characteristics from State to State.

As with the other communicable diseases, the objectives of tuberculosis morbidity reporting are ordinarily considered threefold:

1. For protection of the health of the patient's family and the community.
2. For aiding in providing better care to individual patients.
3. For statistical and administrative purposes.

The last point is the primary concern of this paper. Our data are based on information from the semiannual tuberculosis reports, the National Office of Vital Statistics special report on notifiable diseases, 1947-50, and other reports provided by the various States.

Morbidity statistics may be used for a number of purposes, among them measurement of the extent of the tuberculosis problem and trends therein, the distribution of the disease, geographically and by other characteristics, and the success of the control program in reducing the problem, particularly the success of case finding. Figures on morbidity reporting are

sometimes used in apparently contradictory ways. For instance, increases in morbidity reporting may be interpreted as an indication of improved case finding, but decreases may be interpreted as an indication of decreased incidence or occurrence of the disease. Care must therefore be taken in interpreting morbidity reports lest unwarranted conclusions be drawn. The reasons for changes in reported morbidity cannot be ascertained from an examination of the figures alone. A knowledge of the actual operation of the control program and of some of the underlying conditions affecting reporting is necessary for interpretation of the data.

New Cases Reported in 1951

The total of 118,491 tuberculosis cases newly reported in the United States in 1951 (that is, reported for the first time) is slightly less than that for 1950 and represents a decline of 13.0 percent from the 1947-48 high. The decline in the rate of new cases reported per 100,000 population was 17.8 percent: from 94.0 in the 1947-1948 period to 77.3 in 1951.

The decrease in numbers of tuberculosis cases newly reported in the United States during the past several years has not been uniform for all States (table 1). Eleven States showed increases in the number of cases reported in 1951 as compared with the 1947-48 average, while the remaining States showed decreases. Several of the States showing increases were among those with low levels of reporting in 1947-48. Sixteen States, the District of Columbia, and the Territory of Hawaii showed decreases of more than 20 percent. For most of the States

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Table 1. Tuberculosis cases newly reported, 1951, and percentage change from 1947-48 average, United States, each State and Territory

State	New cases reported 1951	Percent change as compared with 1947-48 average
Total, continental United States.....	118, 491	-13. 0
Alabama.....	2, 661	-8. 6
Arizona.....	3, 772	+66. 1
Arkansas.....	2, 174	-0. 6
California.....	8, 426	-7. 0
Colorado.....	1, 669	+2. 6
Connecticut.....	1, 515	+8. 4
Delaware.....	273	-5. 9
District of Columbia.....	1, 907	-46. 4
Florida.....	2, 590	-32. 3
Georgia.....	2, 502	-22. 2
Idaho.....	237	+25. 4
Illinois.....	6, 949	-5. 8
Indiana.....	2, 032	-19. 8
Iowa.....	829	-11. 7
Kansas.....	562	-46. 7
Kentucky.....	3, 429	+65. 3
Louisiana.....	2, 639	-14. 8
Maine.....	450	-13. 8
Maryland.....	2, 687	-11. 8
Massachusetts.....	2, 293	-18. 4
Michigan.....	6, 144	-2. 3
Minnesota.....	2, 208	-35. 4
Mississippi.....	1, 444	-33. 0
Missouri.....	2, 658	-6. 9
Montana.....	320	-48. 3
Nebraska.....	297	-36. 9
Nevada.....	215	+27. 6
New Hampshire.....	207	+30. 2
New Jersey.....	3, 246	+3. 0
New Mexico.....	767	-48. 3
New York.....	12, 129	-8. 9
North Carolina.....	3, 106	-9. 5
North Dakota.....	218	-32. 0
Ohio.....	7, 351	-15. 7
Oklahoma.....	1, 763	-26. 3
Oregon.....	765	-10. 8
Pennsylvania.....	6, 220	+17. 1
Rhode Island.....	394	-31. 7
South Carolina.....	1, 268	-18. 7
South Dakota.....	261	-7. 4
Tennessee.....	3, 552	-37. 5
Texas.....	4, 415	-35. 3
Utah.....	231	+100. 0
Vermont.....	263	-8. 2
Virginia.....	3, 804	-6. 1
Washington.....	2, 046	-24. 9
West Virginia.....	1, 806	-24. 4
Wisconsin.....	1, 706	-31. 9
Wyoming.....	91	+62. 5
Alaska.....	589	-4. 8
Hawaii.....	551	-58. 8
Puerto Rico.....	6, 075	-11. 7

showing major changes, the increase or decrease appears to be due in part to changes either in administrative procedures or in the extent of X-ray and other case-finding activities in the State.

Factors Influencing Reporting

The level of morbidity reported is influenced by three broad groups of factors:

1. The number of new cases developing during the year, together with the number of unknown cases existing at the beginning of the year.

2. The success of efforts to find these cases.

3. The completeness of reporting diagnosed cases to the health departments and the types of cases which are included in compilations of morbidity by those departments.

Changes in numbers of cases reported from year to year and variation from area to area may be due to changes or variations in any one or a combination of the above factors. These factors will be considered in reverse order in relation to the 1947-51 data.

There are variations among the States in the types of tuberculosis cases which are reported. In some States—for example, California and Massachusetts—the usual practice is to count active cases only, while some other areas include in their counts cases of borderline significance. Such differences in procedures have been described (1) and recommendations have been made and adopted by the State tuberculosis control officers (2) for further improving the usefulness of morbidity reporting in tuberculosis, particularly for counting the active and probably active cases separately from other reportable cases. Available information indicates that as much as one-fourth of the decline from 1947-48 to 1951 may be due to the decreases in the reporting of arrested cases.

Completeness of reporting also varies from area to area. While it is a truism that 100-percent reporting is ordinarily impractical it is possible to approach completeness. For example, in some areas more than 90 percent of persons dying from tuberculosis are reported cases prior to death, while in other areas only about 50 percent of these deaths are so reported. Those communities reporting practically all of

their cases prior to death are more nearly approaching complete reporting than those which report only half of tuberculosis decedents as living cases.

Examination of morbidity figures by source of report shows that reports from all major sources declined in the period under consideration. It would not therefore appear that changes in completeness of reporting from any one source would account for the 13-percent decline in reported cases from 1947-48 to 1951.

Efforts to find cases have apparently not fallen off in the United States as a whole since 1947 (3). In fact, the number of X-rays taken in case-finding programs in 1951, although less than in 1950, was 2½ million more than the annual average for 1947-48. In some States, however, changes have occurred. For some, more extensive case-finding activities have resulted in increases in the number of cases found. For a few States, the decreases appear to be due, in part at least, to less extensive case-finding activities. For example, the District of Columbia had a community-wide survey in 1948 which resulted in an unusually large number of new cases being reported; the number of X-rays taken in 1951 and therefore the number of new cases reported in that year are substantially below the 1947-48 level, although they are still above the average for the United States.

Since other factors will apparently thus account for only a relatively modest portion of the decline in the total number of newly reported cases for 1951 as compared with 1947-48, it seems reasonable to infer that there has been a decrease either in the number of new cases of tuberculosis developing each year or in the number of unknown significant cases existing in the population, or in both.

In order to emphasize that it is the number of known cases that determines the amount of tuberculosis services to be furnished by the tuberculosis control program, it must be mentioned that there does not appear to be any appreciable decline in the number of known cases of tuberculosis. This is probably due to two factors: With more extensive case finding in recent years, a higher proportion of the cases are known; and with improved therapy patients are living longer.

Cases per Death

Case finding and reporting have been generally recognized as essential steps in tuberculosis control. If the number of cases which occur were known, the completeness of case finding and reporting could be measured by the ratio of cases found and reported to the total cases occurring. Obviously we do not know how many cases occur and are undiscovered, so the number of deaths from tuberculosis has been used as an index of the occurrence of the disease. The ratio of cases reported per death has therefore been used rather generally to measure the relative extent of case finding and reporting.

The ratio of newly reported cases per death has risen from approximately two per death in 1941 to four new cases per death in 1951, and has risen steadily every year since 1947 (table 2). Improved case finding and reporting appear to be responsible for a part of this increase, although the decline in mortality has played a large part. For purposes of comparison, all the following computations of the ratio of new cases per death have been based upon the average number of tuberculosis deaths for the latest available 3-year period by State, that is, for 1947-49.

Table 2. Newly reported tuberculosis cases, cases per death, and rate per 100,000 population, United States, 1947-51

Year	New cases reported	New cases per death	New cases per 100,000 population
1947-----	135, 118	2.8	94.2
1948-----	137, 192	3.1	93.9
1949-----	134, 865	3.4	90.8
1950-----	121, 636	¹ 3.6	80.4
1951-----	118, 491	¹ 4.0	77.3

¹ Based upon tuberculosis deaths estimated by NOVS from 10-percent sample.

It must be remembered, however, that this ratio is affected by the case fatality rate, varying inversely with it; the higher the case fatality rate, the lower the case-death ratio and vice versa. That is, as more patients recover instead of dying, the ratio will be higher. Thus, further stress is placed upon the desirability

of a high ratio of new cases per death, indicating better case finding and reporting and/or lower case fatality. In some instances, however, variation in case-death ratios are due, in part at least, to variations in reporting practices.

Table 3 shows the 1949-51 averages of newly reported cases by State, together with the ratios of new cases per death. The 3-year average has been used to minimize fluctuations due to the effects of mass X-ray surveys, changes in reporting practices, and other variables. For the various States, new cases reported per death range from 1.8 to 6.5, with an average of 2.9 for the country as a whole. The northeastern States tend to have lower ratios than do other areas (fig. 1), while the 11 western States as a group have higher ratios, as do also the central States along the northern border of the country. There is, however, a substantial variation in the ratios from State to State within each region.

Race and Sex

During the period under study, the tuberculosis death rate among nonwhites was approximately three and one-half times the rate among whites. In view of this marked difference, it is important to consider differences by race in cases reported. The 1949-51 summaries of newly reported cases by race and sex for 46 States and the District of Columbia show rates per 100,000 population (1950 census) as follows:

	Total	Male	Female
White.....	71.7	90.5	54.6
Nonwhite.....	179.1	203.9	153.9

Thus the rate of newly reported tuberculosis cases among nonwhite persons was approximately two and one-half times that among white persons. In both groups the rates are higher among males than among females.

The latest 3-year period for which complete mortality tabulations are available by race and sex is 1947-49; using these mortality data, the ratios of newly reported tuberculosis cases per death, by race and sex, are:

	Total	Male	Female
White.....	3.2	2.9	3.8
Nonwhite.....	2.2	2.2	2.2

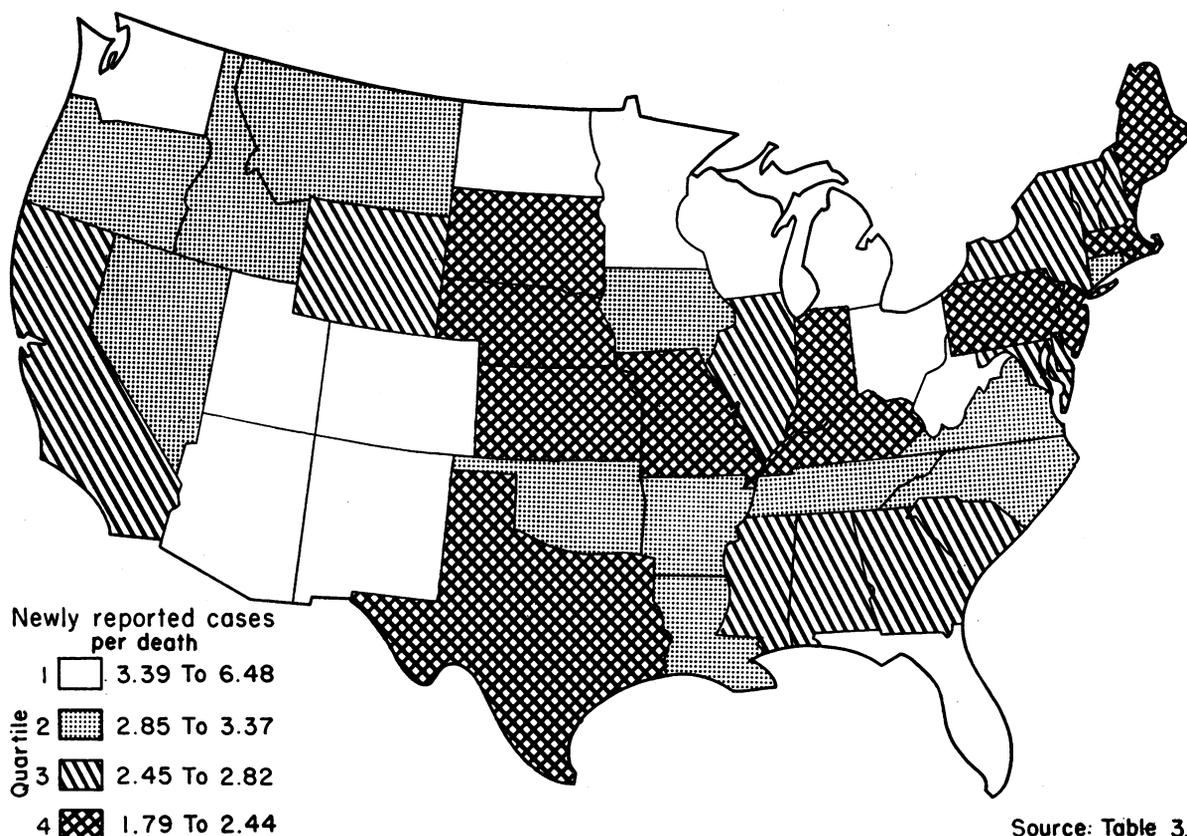
Table 3. Tuberculosis cases newly reported, 1949-51 average, ratio per death and rate per 100,000 population, United States and Territories

State	New cases reported 1949-51 average	New cases reported per death ¹	New cases reported per 100,000 population ²
Total, continental United States.....	125, 033	2.9	82.7
Alabama.....	2, 793	2.7	91.2
Arizona.....	2, 942	5.0	390.2
Arkansas.....	2, 120	2.9	110.8
California.....	8, 681	2.7	82.0
Colorado.....	2, 111	6.5	157.7
Connecticut.....	1, 425	2.9	70.8
Delaware.....	300	2.5	94.1
District of Columbia.....	1, 723	3.8	218.1
Florida.....	2, 708	3.7	97.1
Georgia.....	2, 787	2.8	80.6
Idaho.....	220	3.3	37.2
Illinois.....	7, 512	2.8	85.8
Indiana.....	2, 224	2.4	56.3
Iowa.....	859	3.2	32.6
Kansas.....	612	2.3	31.9
Kentucky.....	3, 125	2.3	105.7
Louisiana.....	2, 647	2.9	98.5
Maine.....	472	2.4	51.3
Maryland.....	2, 728	2.6	116.0
Massachusetts.....	2, 458	1.8	52.3
Michigan.....	5, 879	3.8	91.9
Minnesota.....	2, 559	5.3	85.2
Mississippi.....	1, 852	2.8	84.9
Missouri.....	2, 729	2.4	68.7
Montana.....	411	3.0	68.7
Nebraska.....	310	1.8	23.2
Nevada.....	180	3.1	112.7
New Hampshire.....	183	2.4	34.1
New Jersey.....	3, 408	2.4	70.0
New Mexico.....	1, 935	3.4	149.8
New York.....	12, 845	2.6	86.1
North Carolina.....	3, 387	3.3	83.0
North Dakota.....	252	3.5	40.3
Ohio.....	8, 558	3.9	107.5
Oklahoma.....	2, 065	3.4	92.5
Oregon.....	749	2.9	49.1
Pennsylvania.....	5, 993	1.9	56.8
Rhode Island.....	457	2.3	58.0
South Carolina.....	1, 326	2.5	62.5
South Dakota.....	287	2.2	43.5
Tennessee.....	4, 461	3.2	135.3
Texas.....	4, 966	1.9	64.3
Utah.....	270	3.9	38.8
Vermont.....	307	2.8	80.7
Virginia.....	3, 625	3.3	109.4
Washington.....	2, 317	4.3	97.3
West Virginia.....	2, 121	3.5	105.5
Wisconsin.....	1, 972	3.9	57.1
Wyoming.....	82	2.7	28.3
Alaska.....	720	3.1	559.5
Hawaii.....	634	3.6	126.9
Puerto Rico.....	6, 391	1.7	289.1

¹ 1947-49 average number of tuberculosis deaths.

² Population sources: For continental United States—July 1, 1950, Bureau of Census reports. For Territories—Apr. 1, 1950, Bureau of Census reports.

Figure 1. Tuberculosis cases newly reported per death, United States, 1949-51.



Source: Table 3.

The high ratio of new cases reported per death for white females may mean that case finding and reporting are more effective among them than among white males, or it may be due to the fact that white females have lower death rates than do white males. Information from specific communities indicates that both factors are of importance.

Because tuberculosis is known to be more frequently fatal among nonwhites and because arrested tuberculosis is less frequently discovered in surveys among this group, one would expect to find a lower ratio of new cases per death in nonwhites than in whites. It is difficult, therefore, to compare case finding and reporting among nonwhites with that among whites on the basis of case-death ratios.

The ratio of new cases reported per death for each race varies from State to State (table 4) and from region to region, as is seen in the following summary table.

Region	New cases per death	
	White	Nonwhite
Northeast.....	2.3	2.4
South.....	3.8	1.9
North Central.....	3.4	2.6
West.....	3.5	3.0
Total.....	3.2	2.2

For whites, the South has the highest ratio of reporting; the Northeast the lowest. For nonwhites, the West has the highest level of reporting; the South the lowest. The Northeast has a slightly higher ratio for nonwhites than for whites, while the West and North Central States as a group have a ratio of reporting for nonwhites approximately four-fifths as high as for whites. The ratio of new cases per death for nonwhites in the South is only half that for the whites. Part of the explanation of the lower ratios of reporting for nonwhites may lie in the practice of reporting probably inactive cases and the generally recognized smaller number of arrested cases among nonwhites.

Table 4. New tuberculosis cases reported and cases per death by race and State, 46 States, District of Columbia, and Territories, 1949-51 average

State	New cases reported ¹		New cases per death ²		State	New cases reported ¹		New cases per death ²	
	White	Non-white	White	Non-white		White	Non-white	White	Non-White
Total, 46 States and District of Columbia.....	89, 767	26, 221	3. 2	2. 2	Montana.....	308	94	3. 4	2. 1
Alabama.....	1, 740	1, 052	3. 8	1. 8	Nebraska.....	293	16	2. 0	. 6
Arizona.....	2, 426	403	5. 8	2. 4	Nevada.....	163	3	3. 7	(³)
Arkansas.....	1, 615	496	3. 6	1. 8	New Hampshire.....	183	0	2. 5	(³)
California.....	7, 248	1, 626	2. 7	3. 3	New Jersey.....	2, 627	683	2. 5	2. 0
Colorado.....	2, 239	89	7. 4	3. 9	New Mexico.....	857	178	3. 8	2. 2
Connecticut.....	1, 224	107	2. 8	2. 1	New York ⁴	9, 593	3, 244	2. 5	2. 8
Delaware.....	223	77	2. 9	1. 7	North Carolina.....	2, 009	1, 382	4. 9	2. 3
District of Columbia.....	838	828	5. 6	2. 7	North Dakota.....	196	48	3. 3	(³)
Florida.....	2, 031	659	5. 8	1. 7	Ohio.....	6, 945	1, 612	4. 4	2. 8
Georgia.....	1, 654	1, 140	4. 2	1. 9	Oklahoma.....	1, 701	353	3. 9	2. 0
Idaho.....	124	27	2. 1	(³)	Oregon.....	686	57	2. 9	2. 3
Illinois.....	5, 605	1, 888	2. 9	2. 5	Pennsylvania ⁴	4, 375	1, 437	1. 9	2. 0
Indiana.....	1, 843	298	2. 4	1. 8	Rhode Island.....	391	29	2. 2	1. 6
Iowa.....	669	45	2. 6	(³)	South Carolina.....	703	621	4. 4	1. 7
Kansas.....	554	71	2. 5	2. 0	South Dakota.....	173	114	2. 5	1. 9
Kentucky.....	2, 699	287	2. 4	1. 2	Tennessee.....	3, 556	802	3. 6	2. 0
Louisiana.....	1, 560	984	3. 8	2. 0	Utah.....	230	43	4. 0	(³)
Maine.....	478	1	2. 5	(³)	Vermont.....	307	0	2. 8	(³)
Maryland.....	1, 797	932	3. 4	1. 8	Virginia.....	2, 479	1, 091	4. 4	2. 0
Michigan.....	4, 516	1, 412	4. 0	3. 3	Washington.....	1, 867	306	4. 0	3. 9
Minnesota.....	2, 399	84	5. 3	3. 0	West Virginia.....	1, 924	211	3. 7	2. 3
Mississippi.....	924	838	4. 3	1. 9	Wisconsin.....	1, 602	129	3. 4	4. 6
Missouri.....	2, 124	396	2. 5	1. 5	Wyoming.....	69	28	2. 8	(³)
					Alaska.....	56	683	2. 4	3. 3
					Hawaii.....	75	647	4. 5	4. 1
					Puerto Rico.....	5, 484	808	1. 9	1. 0

¹ From semiannual tuberculosis reports only, excluding cases with race not specified. The sums of white and nonwhite cases by State are frequently not identical with the latest available totals presented in table 3.

² Based upon latest available 3-year average of deaths by race, 1947-49.

³ Ratios not computed for States having fewer than 50 nonwhite tuberculosis deaths in the 3-year period.

⁴ 2-year average.

Fourteen States and one Territory had ratios of four or more new cases reported per death for whites, while only one State and one Territory had a ratio this high for nonwhites. Wisconsin, California, New York, Pennsylvania, and Alaska had slightly higher ratios among nonwhites than among whites. It would thus appear that the latter group is possibly placing greater emphasis upon their program of case finding and reporting among nonwhites than among whites.

Source of Report

The source of the report of cases was available for 44 States and the District of Columbia for the period 1949-51. During this period,

private physicians reported about 51,000 new cases or 15 percent of the total (fig. 2). Idaho was first in the proportion of new cases reported by private physicians with 71 percent, while Montana was second with 53 percent. Other States in which more than 30 percent of cases were reported by private physicians were Utah, North Dakota, Oregon, Minnesota, Kentucky, Kansas, Nevada, and Wyoming.

Forty percent of the new cases were reported by chest clinics (fig. 2) and 24 percent by general hospitals and tuberculosis hospitals combined. In some areas, private physicians refer substantial numbers of tuberculosis suspects to chest clinics for completion of clinical study and diagnosis. A low percentage of reports from physicians and a correspondingly high

percentage from clinics should not therefore automatically be construed as evidence of poor cooperation from physicians.

Reporting of tuberculosis by mental institutions has not improved appreciably. For the period 1949-51, less than 3 percent of all new cases were reported by mental institutions, although 8 percent of tuberculosis deaths occurred in such institutions. In spite of a decrease in the number of States which report no tuberculosis cases, or practically none, from mental institutions, there were still a dozen such States in 1951. It is possible that the tuberculosis cases were all diagnosed and reported prior to admission of the patients to mental institutions and that no cases developed while in these institutions. Information from other sources, however, indicates that limited case finding and reporting are more important factors. There is also the possibility that the cases reported by mental institutions are counted as coming from hospitals and other sources. Whatever the explanation, it would seem that the health departments for States with practically no tuberculosis reported from mental institutions are not receiving information needed for directing their tuberculosis control programs in these institutions.

Approximately 11.5 percent of newly reported cases were from sources classified as "Other and unknown"; most of these reports were from Veterans Administration, other Federal agencies, and from notifications of patients moving into one State from another State.

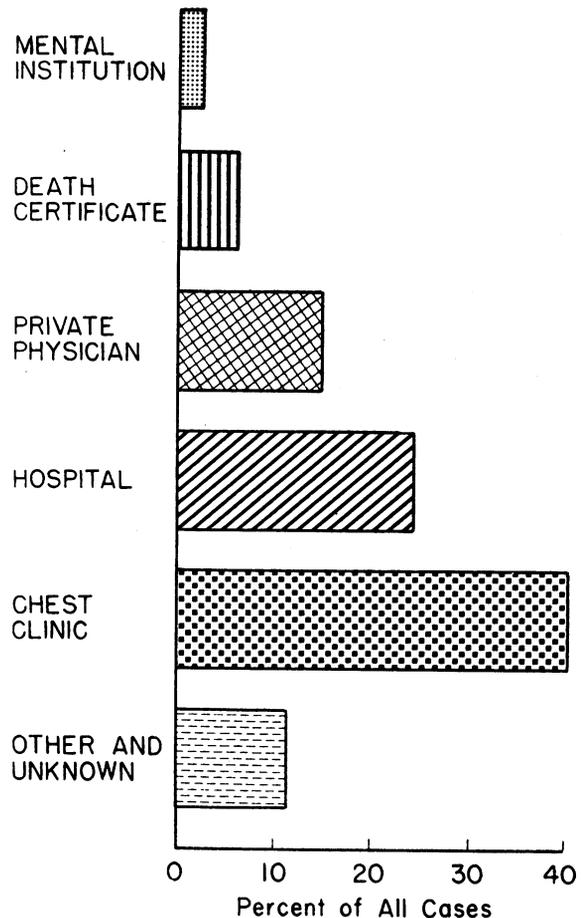
As was mentioned above, there was a decline in cases reported from each of the major sources from 1947-48 to 1951. Cases reported by hospitals declined 11 percent; by clinics, 16 percent; and by private physicians, 30 percent.

New Reporting Procedures

The need for more uniformity in tuberculosis morbidity reporting has been described elsewhere (1) and in a preceding paragraph reference has been made to the new reporting recommendations adopted by the State tuberculosis control officers and sanatorium directors (2). On the basis of these recommendations, the annual and semiannual tuberculosis reports requested by the Public Health Service

from each State and Territory have been revised, effective January 1952. Seven States (Arizona, Arkansas, California, Iowa, Michigan, Oklahoma, and Rhode Island) and the

Figure 2. Source of report of new tuberculosis cases, 1949-51.



District of Columbia provided data on the number of newly reported tuberculosis cases for the year 1951 essentially in accord with the new plan, while Nevada and Tennessee provided such data for the last 6 months of 1951. One State explained that the decline in new cases reported in 1951 was largely due to the application of the new recommendations. In this group of States, approximately three-fourths of the cases reported were active and probably active (group A) cases. The proportion of active cases varied from less than half in one State to practically all cases in another.

We feel that the State tuberculosis control officers and State sanatorium directors are to be

congratulated for their development of the new reporting recommendations. The application of these recommendations will provide each health department with more specific information regarding the number of people sick with tuberculosis who are just becoming known to the health department. Each community will thus be able to plan more effectively and more economically for the operation of its program.

Summary

1. The statistical and administrative uses of tuberculosis reporting are the measurement of the extent of the tuberculosis problem and the trends therein, the distribution of the disease, geographically and by other characteristics, and the success of the control program in reducing the problem, particularly the success of case finding. Care must be taken in interpreting morbidity reports, since variations in reporting levels may reflect not only changes in the actual number of cases, but the success of case-finding efforts and reporting practices.

2. In 1951, 118,491 new cases of tuberculosis were reported in the United States, a decline of

13.0 percent from the 1947-48 peak. This is four times the number of tuberculosis deaths, or a ratio of four new cases reported per death, the highest ratio for any year since reports have been tabulated.

3. The ratio of new cases reported per death is substantially higher for whites than for nonwhites. Regionally, the South had the highest ratio of reporting for whites, and the lowest ratio of reporting for nonwhites.

4. Of the total new cases reported during 1949-51, about 40 percent were reported by chest clinics, 25 percent by hospitals, and 15 percent by private physicians. Less than 3 percent of the new cases were reported by mental institutions, although 8 percent of the tuberculosis deaths occur in such institutions.

REFERENCES

- (1) Northrop, Cedric, Anderson, Robert J., and Sauer, Herbert I.: What is a reportable case of tuberculosis? *Pub. Health Rep.* 64: 961-968 (1949).
- (2) U. S. Public Health Service: What is a reportable case of tuberculosis? *Pub. Health Rep.* 66: 1291-1294 (1951).
- (3) Enterline, Philip: Group chest examinations and the tuberculosis death rate. *Pub. Health Rep.* 67: 762-766 (1952).

National Science Foundation Fellowships

The National Science Foundation, Washington, D. C., in its graduate fellowship program for the academic year 1953-54, will offer awards to medical students who are interested in careers in medical research. The fellowships range from \$1,400 for first-year fellows to \$3,400 for postdoctoral fellows. No awards will be given for study in clinical medicine.